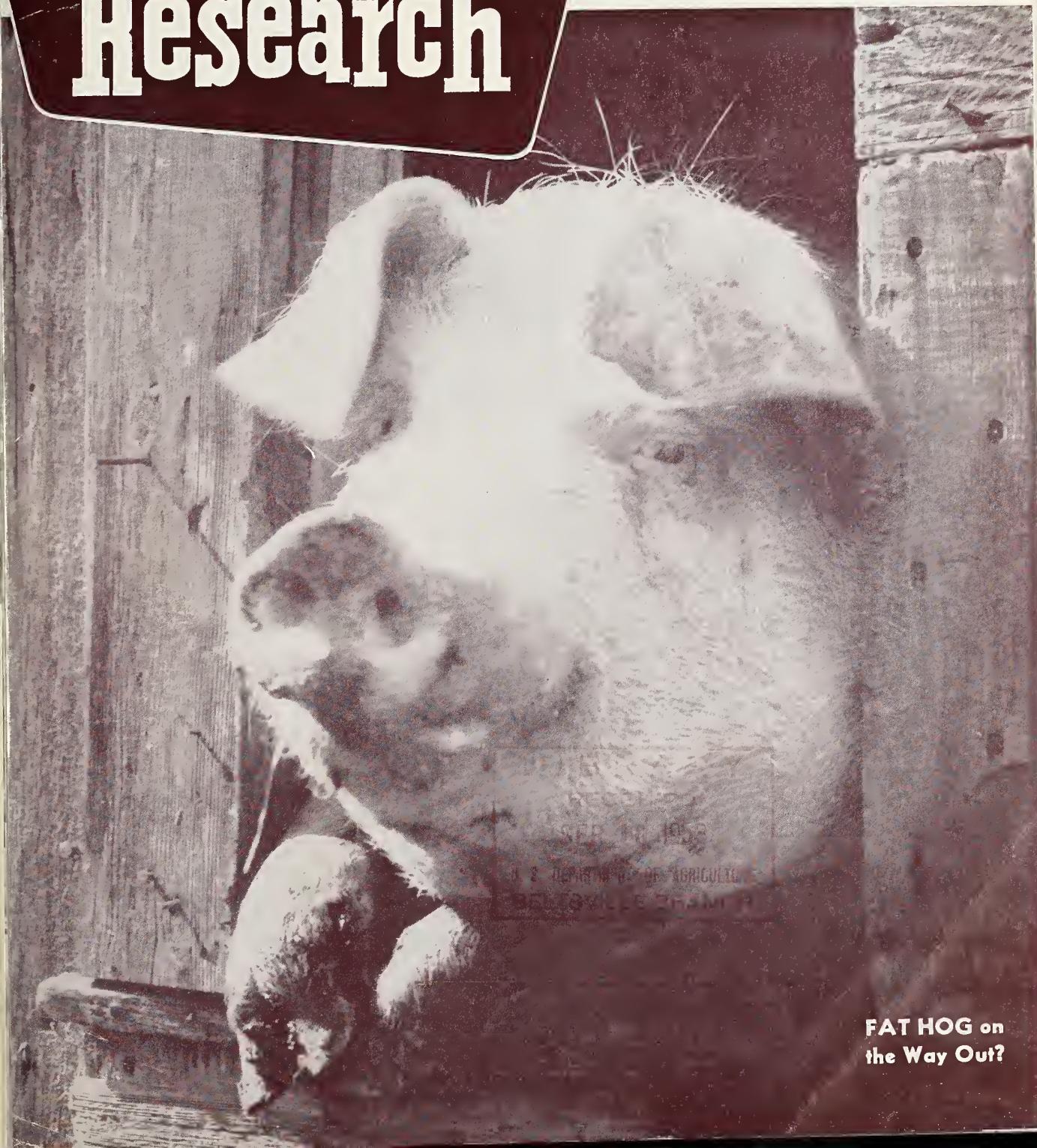
AGRICULTURAL Research

SEPTEMBER 1953



FAT HOG on the Way Out?

AGRICULTURAL
Research

VOL. 2—SEPTEMBER 1953—NO. 3

THOMAS McGINTY—EDITOR
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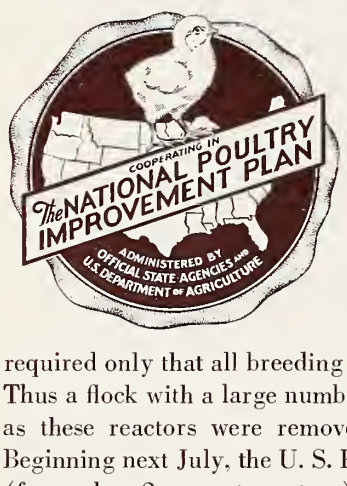
Salute to NPIP

A new low in pullorum disease among flocks in the National Poultry Improvement Plan has just been reported to the Bureau of Animal Industry by the 47 cooperating States. Average number of reactors (infected birds) this year dropped to 0.23 percent of the 36 million chickens tested in the program.

Control of pullorum disease, formerly the hardest hitting bacterial disease of poultry, is an integral part of NPIP, a voluntary program in which Federal and State workers and industry members are cooperating to improve poultry through breeding and disease control. Participation has steadily increased, until about two-thirds of total U. S. hatchery-incubator capacity is now under NPIP supervision.



Another significant trend has been the progressively stiffer requirements set for themselves by NPIP members. When the plan was inaugurated in 1935, the lowest class for breeding birds and chicks was U. S. Pullorum-Tested, which required only that all breeding birds be tested and the reactors removed. Thus a flock with a large number of infected birds could qualify so long as these reactors were removed. This class has since been deleted. Beginning next July, the U. S. Pullorum-Controlled class, now the lowest (fewer than 2 percent reactors), will qualify only those flocks that show fewer than 1 percent reactors. These reactors of course must be removed. Then, in 1956, this class also will be deleted, and all NPIP flocks will have to qualify for the U. S. Pullorum-Passed or U. S. Pullorum-Clean classes, which permit no reactors.

Pullorum-disease control and hatchery sanitation called for by NPIP have increased livability of chicks 6 to 8 percent. Based on the 1¾ billion chicks hatched last year, a 1-percent increase in livability saves the poultry industry 3½ million dollars annually.

AGRICULTURAL RESEARCH ADMINISTRATION
United States Department of Agriculture

SQUEEZED between low lard prices and high demand for leaner pork, the too-fat hog hardly fits today's market. It's time the research-tested, meat-type hog took over. (Story on pages 8–9.)

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Exploring proteins with the Glass Stomach

A GLASS STOMACH has opened the way to important research advances in nutrition.

This device, which breaks down food in much the same way as our own digestive system, was developed by the Bureau of Human Nutrition and Home Economics. Everyone who grows or processes food—in fact, everyone who eats food—stands to profit from the discovery.

It's already helping us learn more about the body-building material called protein—chemical basis of all living cells. We're finding out how cooking improves some food protein but damages others.

All sorts of plants and animals furnish proteins, which digestion breaks down into about 20 materials known as amino acids. Using these amino-acid building blocks, the body constructs new proteins to fit the needs of each tissue. Protein makes up about 18 percent of the human body, including most of the hair, nails, and skin, muscles and organs, even the enzymes and hormones that control our body processes.

All the amino acids are needed to build body proteins. Most animals can make their own supply of about half of them, leaving 8 to 10 that must be supplied in the diet. It's plain that the protein value of a food depends on how much of the amino acids—particularly the 10 so-called essential ones—the food contains.

Finding that out, even for a single protein, was once a tedious process that took months. Few foods were ever completely analyzed.

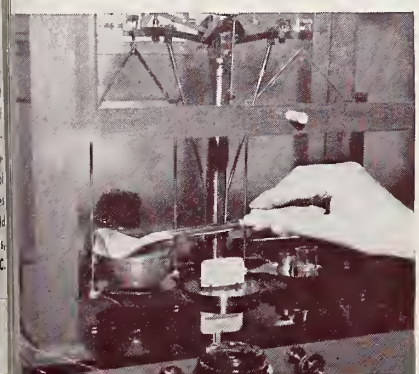
The first big advance came when Bureau biochemists helped develop a way of making bacteria do the work. It seems that certain bacteria, like animals, need the amino acids to survive and grow. Among such bacteria are those that produce lactic acid, familiar in milk and silage.

Suppose we want to measure the amount of a certain amino acid (say, lysine) in wheat. The grain is finely ground, then broken down with strong hydrochloric acid. Some of this mixture is added to a tube containing 19 of the amino acids—all except lysine—plus other nutrients the bacteria need. Now a drop of the lactic-acid bacteria is added to the tube. How well the bacteria grow depends on how much lysine the wheat provides. Growth is measured by the amount of lactic acid produced.

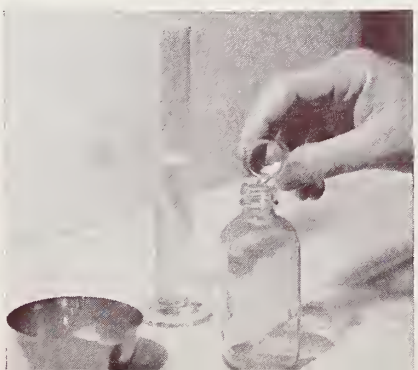
The method is quick and accurate—but the scientists soon learned that it doesn't tell the whole story. It showed no change in amino-acid content of some foods before and after cooking. Yet, rats made good gains on raw food but poor gains on the same food cooked. Evidently, severe

How the glass stomach helps scientists measure the protein value of food:

1 First step in new, short method for measuring nutritive value of protein is to grind food fine, then weigh out 1-gram sample (about 1/28 ounce). This test shows how much of the 10 essential amino acids the food offers in a form the digestive system can use.



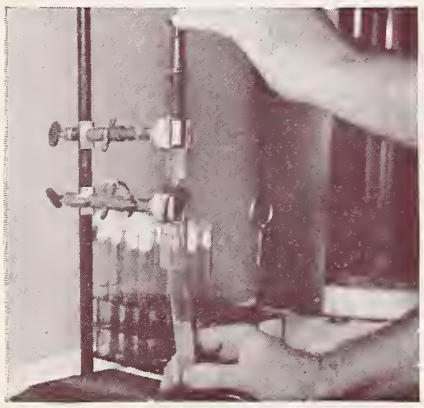
2 Food sample is put in the glass stomach—a small bottle with a rubber-lined cap. Now, two-hundredths of a gram of the enzyme pepsin is added, plus some dilute hydrochloric acid. Digestion takes place in much the same way as it does in the human stomach.



3 Glass stomachs turn gently on this machine, in a room heated to body temperature. After 24 hours, M. J. Horn adds trypsin. A day later, he puts in mucosa from hog intestine; this adds 10 to 15 more enzymes that help break down the protein. (See page 4.)

4 Digested material—available amino acids now free—is put in larger bottle. Adding water increases solution to a standard volume. Some solution is placed in test tube, together with all the nutrients (except amino acids) that lactic-acid-producing bacteria require.

5 Now, a drop of the lactic-acid bacteria is put in the tube. These bacteria, like the human body, must have amino acids to live. Growth of bacteria during the next 3 days will depend on the total quantity of available amino acids that the food contains.



6 The better the bacteria grow, the more lactic acid they produce, and the cloudier the solution looks. Amount of lactic acid indicates the nutritive value of the protein in the food. To get this information by rat-feeding test would take weeks and cost much more.

heating ties up amino acids—along with carbohydrates, perhaps—so that the digestive system can't break them down. Treatment with hydrochloric acid released them for use by the bacteria, but the milder digestive juices of the rat's stomach were unable to do this. In short, the amino acids were still there, but they weren't available to the animal.

What researchers needed was a test that gave results in terms of feeding value. That's what counts.

Then came the glass stomach—an attempt to simulate animal digestion—in which ground food is broken down in a bottle with mild acids, gentle motion, and natural enzymes. This digested material, fed to the lactic-acid bacteria, makes available to them about the same proportion of a food's amino acids that natural digestion provides the body.

This was confirmed by tests on 10 cottonseed meals prepared by various methods at the Southern Regional Research Laboratory. Cooking times and temperatures covered a wide range. Bacteria tests for each of the essential amino acids were run on one group of cottonseed-meal samples broken down by the strong-acid method and on another group of the same meals digested by enzymes in the glass stomach. These meals were also fed to rats.

The acid test showed no difference in the meals. But the glass stomach agreed with the rats: the longer the cooking time and the higher the temperature, the more of the amino acids were bound up. (Only the most severe temperatures and pressures actually destroyed the protein.)

Researchers can run hundreds of samples in a few days with the glass stomach for less than the cost of a rat test, which takes many weeks and a thousand times as much material.

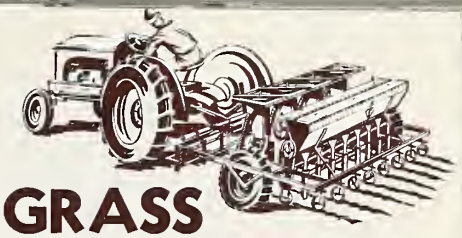
Success with the glass stomach recently led to the development of another short cut by M. J. Horn, A. E. Blum, and Madelyn Womack. The cottonseed-meal experiments indicated that the nutritive value of a protein depends on the *available* essential amino acids. That involved 10 separate tests. It now occurred to the scientists that they might get a good measure of nutritive value with a single test in which the bacteria, like the rats, got no amino acids except those that the cottonseed meal furnished. The idea worked (see pictures on pages 3 and 4).

Horn is convinced that this method can be used for all kinds of foods to measure protein quality as well as to detect changes due to heat, storage, and processing. Being rapid and inexpensive, the test has possibilities of wide use in industry and defense.

Research now under way is showing for the first time what ordinary cooking does to the proteins of common foods. Some 40 foods, raw and cooked, have been checked so far by the glass-stomach test to see how much of each essential amino acid they contain and how much is available to the bacteria. Animal proteins such as those in meat, milk, and eggs, well-known for their high nutritive value, aren't damaged by cooking. Some are even improved. Vegetable proteins, on the other hand, may be hit hard. Severe heat seems to tie up half or more of the amino acids in such foods as wheat, peas, and beans.

This indicates that we need to study our modern cooking methods. Horn thinks that quick electronic cookery might offer a way to save most of the nutritional value of proteins. In the meantime, housewives will do well to hold down cooking times and temperatures as much as possible.

Eventually, food-composition tables probably will show available protein content and complete amino-acid distribution. It will then be possible to plan nutritious meals using low-cost proteins that complement each other in terms of amino acids.



Precision Planting for MORE GRASS

Drill-seeding of grasses and legumes, plus simultaneous banding of fertilizer below the seed, looks like a good way to take part of the gamble out of grassland farming.

This seed-saving method of establishing forage crops gave strikingly successful results in one year's limited tests at Beltsville, Md., reported by R. E. Wagner and W. C. Hulburt of the Bureau of Plant Industry, Soils, and Agricultural Engineering.

Further trials are in progress—at State experiment stations and at ARA's Beltsville research center. If their results confirm those already obtained, conventional broadcasting of seed and fertilizer may be on the way out for planting pastures and hay crops in some areas.

As farmers know, it often takes more seed to establish grassland crops than really should be necessary. Even when expensive seed and fertilizer are broadcast at high rates, poor stands may result.

A reliable way to get good stands with reasonable seeding rates—or to insure against stand failure—is much needed. The Beltsville tests point toward precision seeding and fertilizer placement as a likely answer.

Better stands and more forage production were obtained with these methods than by broadcasting, even when only half as much seed and one-third as much fertilizer were used.

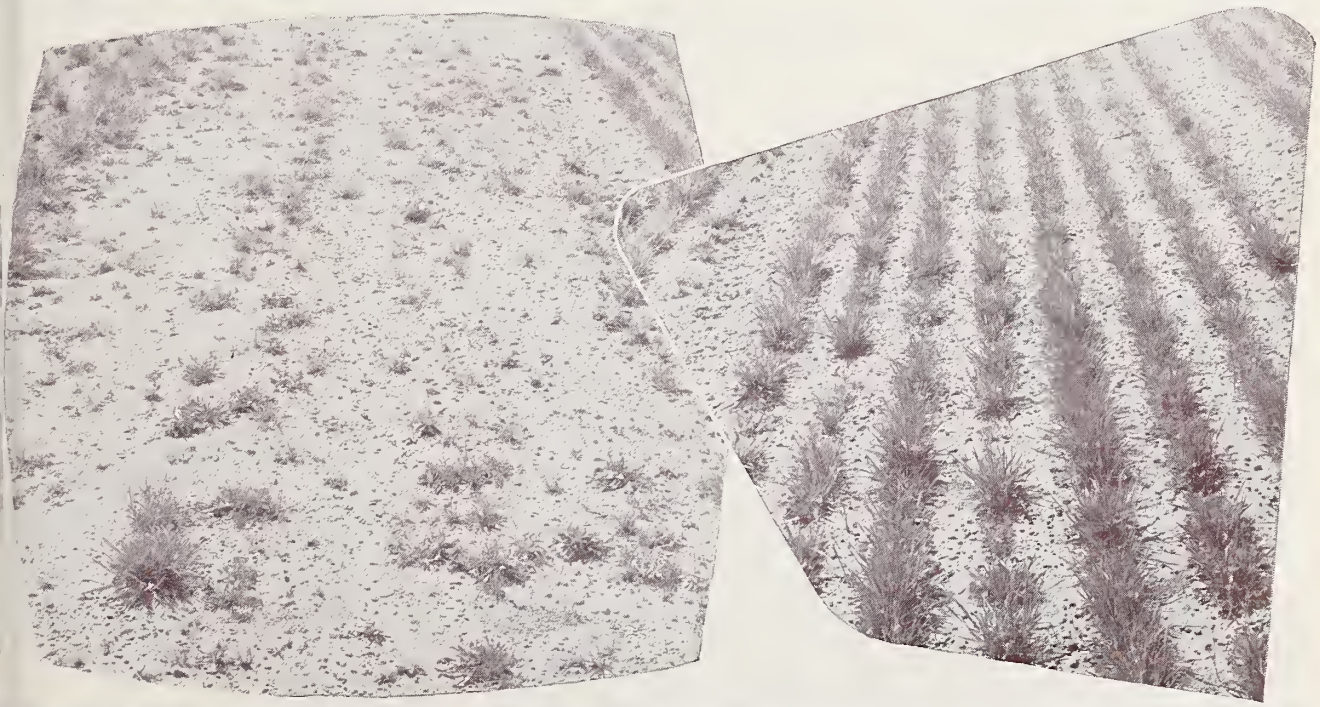
Broadcasting seed and fertilizer at fairly high rates—8 pounds of tall fescue, 2 pounds of Ladino clover, and 750 pounds of 3–12–6 fertilizer per acre—produced 1,439 pounds per acre of dry, weed-free forage at the first harvest in May.

But drilling the same amount of seed in 8-inch rows and banding an equal quantity of fertilizer 1 inch below, with soil firmed over the seed, produced well over twice as much dry forage—3,331 pounds per acre.

When rates for seed and fertilizer were reduced—to 4 pounds of tall fescue, 1 pound of Ladino clover, and 250 pounds of 3–12–6 fertilizer per acre—seed drilling and fertilizer placement still produced an initial harvest of 1,855 pounds of dry, weed-free forage, or 28 percent more than when the seed and fertilizer were broadcast at the higher rates.

For these tests, ARA engineers developed a special planting machine that will drill both seed and fertilizer as desired in one operation.

The test plantings were made about mid-September last year on a sandy



BROADCASTING at low rates—4 lb. tall fescue, 1 lb. Ladino clover, 250 lb. 3–12–6 fertilizer per acre—mainly encouraged the weeds.

DRILLING seed in 8-inch rows and banding fertilizer 1 inch below the seed, even at low per-acre rates, gave good stands with few weeds.

loam soil. Emergence of all plots was good, but in a few days the advantage of banding fertilizer below the seed was noticeable.

In plots where seed was broadcast and fertilizer drilled 1 inch below the surface in 8-inch rows, plants directly over the fertilizer made enough growth to survive the winter, but most others did not. By early spring, these plots looked about as if the seed had been drilled in rows rather than broadcast. It was obvious that broadcasting, in effect, resulted in wasting much of the seed.

Other test plots showed that considerable advantage is gained in drilling seed, even though fertilizer is broadcast, if high rates of speed and fertilizer are used.

The best position for fertilizer with respect to seed has not yet been precisely determined. When it was placed 1 inch to the side and 1 inch below the seed, good stands and production resulted, but they were still inferior to those obtained by placing the fertilizer 1 inch below the seed. Nevertheless, the former pattern is safer if dry weather follows planting. Tests showed also that fertilizer applied at 750 pounds per acre and placed in contact with the seed seriously suppressed stands of clover.

It's clear that distance of fertilizer from the seed is critical. The right position seems to be close to the seed, but not too close.

Precision planting also had a marked effect on weeds. When seed and fertilizer were broadcast, especially at low rates, weed growth was plentiful. But when both seed and fertilizer were drilled, very few weeds appeared, regardless of the rate of fertilization or seeding.

Though these findings are preliminary, they indicate that real opportunities exist for insuring better stands of grasses and legumes at reduced seeding rates through precision seeding and fertilizer placement.

VAPOR ACTIVITY is measured by spraying weed killer on filter paper, which is dried, hung above plant in sealed cellophane bag. Bean on right shows effect of 2,4-D-ester vapor after 24 hours in dark at 80° to 90°.

Weed killers and Volatility

Farmers and gardeners have had some puzzling experiences with weed killers: a treatment on one person's lawn injured shrubs around the house next door . . . pre-emergence sprays unexpectedly damaged cotton seedlings . . . certain herbicides worked well in one place but failed in another.

The answer may have been vapors. Although most weed-killing chemicals were once thought to be non-volatile, we now know that many of them do evaporate after they're applied. This raises new difficulties completely apart from the more familiar hazard of drifting sprays.

Vapors—harmless in some cases, deadly in others—may move through the air to nearby fields. Sensitive plants react to mere traces. Some weed killers may even vaporize so fast that much of their effect is lost.

So volatility is an important factor in developing better weed killers.

Research on vapors has been done by W. C. Shaw, P. J. Linder, P. C. Marth, and J. W. Mitchell at the Plant Industry Station. Here's a progress report on three major groups of weed killers that chemists have put together from alcohols, chlorine, and the coal-tar product phenol:

Phenoxy compounds

Used on millions of acres yearly to kill brush, and to control broadleaved weeds in grasses and field and horticultural crops. These chemicals are absorbed, then move through the plant. Their effects show up in abnormal growth of leaves and stems.

The parent phenoxy compounds include 2,4-D (2,4-dichlorophenoxyacetic acid), 2,4,5-T (2, 4, 5-trichlorophenoxyacetic acid), and MCP (2-methyl-4-chlorophenoxyacetic acid).

Volatility doesn't seem to be a problem with phenoxy acids, salts, amides, or amines—it's acid-alcohol compounds called esters that often cause trouble. Vapors may travel some distance and damage such sensitive crops as cotton, tomatoes, and grapes.

Some 40 phenoxy esters have been studied. Several of the newer ones, such as butoxy ethanol and propylene glycol, rated low in volatility; some of the older ones, such as isopropyl and butyl, rated high.

Chemists are making new phenoxy compounds that are high in weed-killing punch but low in vapor activity. Dissolving the esters in diesel oil cuts down volatility—and also helps them penetrate and stick better.

Of course, high-vapor phenoxys are still useful for many jobs when there are no sensitive crops nearby.

Dinitro compounds

Used to kill weeds in peas and grain, and as a pre-emergence treatment for broadleaved weeds and grasses in many field crops. These compounds seem to kill by contact; no formative effects have been noted. Injured plants have a burned and shrivelled look.

The parent is DNOSBP (dinitro ortho secondary butyl phenol).

The potential danger in the vapor activity of dinitros, especially the salts, was first demonstrated last year. Their vapors affect some plants more than others (tomatoes and cotton are less tolerant than snap beans) and are most dangerous at the seedling stage. Dinitro vapors don't seem to travel far. But these compounds should be used cautiously, especially near cotton and tomatoes.

Of four DNOSBP formulations tested, vapors from the ammonium salt were most severe, those from alkanolamine least severe. But it was the lingering vapors of the latter that may have damaged pre-emergence-treated cotton in the 1951 season.

Unfortunately, dinitros low in vapor activity also seem to be low in weed-killing power. If chemists can't develop effective compounds with low volatility, they may be able to reduce the vapor activity of present dinitros by combining with other materials.

Carbamate compounds

Used for pre-emergence spray in cotton, to kill annual grasses in alfalfa and onions, control chickweed in strawberries. Carbamates are absorbed by some plants and apparently kill by interfering with normal cell division and cell elongation.

The parent compond is IPC (isopropyl N-phenylcarbamate). A newer member is CIPC (isopropyl N-(3-chlorophenyl) carbamate).

Here we have a different problem. Preliminary research indicates that the vapors of these compounds generally don't do much harm to plants. The trouble is that carbamates, being unusually volatile at high temperatures, may evaporate before killing the weeds. This high rate of evaporation means that farmers must apply larger amounts than would ordinarily be required.

The Bureau's scientists are now making plant tests on the vapor effects of many carbamate compounds.

COTTON SEEDLINGS at right were damaged by vapor from a dinitro-salt formulation after 24 hours in cellophane bag (page 61. Vapors from dinitros cause a brown, spotty, burned look. In contrast, vapors from phenoxys, carbamates produce queer over-all growth effects.

Where are we going with the MEAT-

TWENTY YEARS of research have given us the meat-type hog. He yields more good, lean pork and less fat, pound for pound, than his fat-type cousin. And he's just as economical for farmers to raise.

But that hasn't been enough, so far, to put his better quality bacon, ham, roasts, and pork chops in quantity on the housewife's table. The over-fat hog is still standard, from farm to family breakfast.

One reason is that converting our swine industry to meat-type hogs requires a revolution in production and marketing practices. It isn't here yet, but it's on the way. Economics, as well as research, is behind it.

When the modern housewife buys pork, she wants it lean—and too often she can't get what she wants. Her buying power at the retail meat counter is one economic force pushing for a change in hog models.

Another is the low price of lard. It now brings much less per pound than packers pay for live hogs. Naturally, this tends to raise pork prices for consumers and pull down hog prices paid to farmers.

But producing hogs with leaner pork and less fat still means farm and market changes—and each one must pass the practical test of "Will it pay?" Research shows that the right changes can pay, and that meat-type hogs make dollars and sense in today's market.

On the Farm—Meat-type hogs come in all breeds, says J. H. Zeller, head of ARA's swine-breeding research. Producing them depends on proper selection, breeding, feeding, and marketing at the right weight—all within reach of the average hog farmer.

They can raise just as many pigs, grow just as fast, use feed just as efficiently, and have carcass yields just as high as the best fat-type hogs.

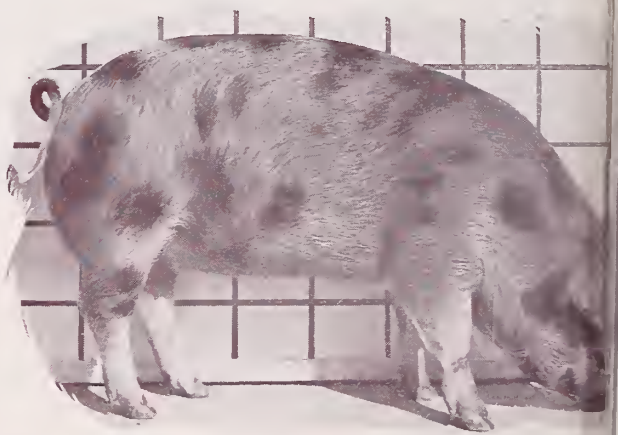
Since the early 1930's, USDA scientists have been working with State experiment stations and private breeders to improve purebred hogs and develop superior crossbreds for more efficient pork production. Six new breeds have been established in the past few years, and others are in the making. By proper combination with older breeds, they will give us more and better meat-type hogs.

Like corn farmers, hog producers benefit from hybrid vigor. Breeders find that crossing purebred hogs with selected meat-type animals can result in 3 to 5 percent more pigs raised, 5 to 7 percent savings in feed, and faster growth that brings hogs to market 10 to 15 days earlier.

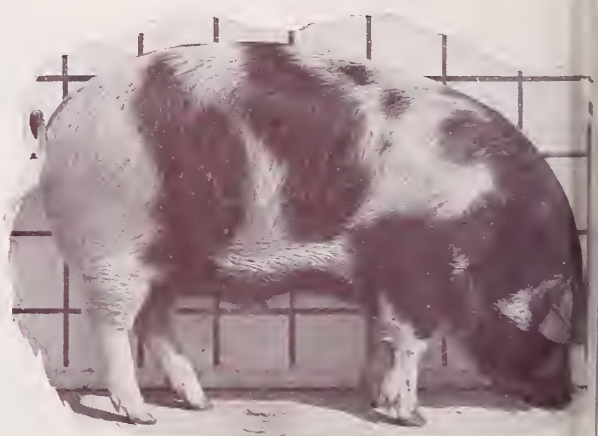
Studies of how hogs use feed reveal that 200–225 pounds is their best weight for market. Above th weight, most hogs turn too much of their feed into fa

In the Market—The meat-type hog, says O. (Hankins, in charge of the Bureau of Animal Industry meat research, produces more of the preferred cuts—loi ham, bacon, shoulder butt, and picnic shoulder—at n sacrifice in dressing percentage. He's a better bargai on two counts: (1) he gives more lean meat per pound

The right hog . . .



MEAT-TYPE HOG is solid but streamlined. With long body and m length legs, it yields over 50 percent of its weight in preferred c crossbred, this hog has an average backfat thickness of 1.73



FAT-TYPE HOG, also a crossbred, is a fine specimen by old stand carries too much fat. Fairly short and heavyset, he has 2.0 i backfat and yields less than half his live weight in the prefer

YPE HOG?

live weight, (2) his pork has greater consumer appeal.

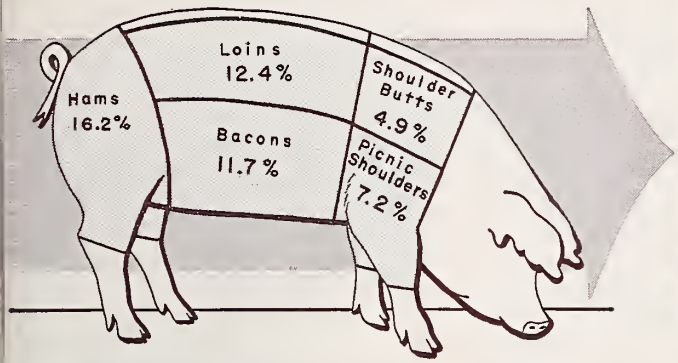
Most hogs are still sold largely by weight alone, which gives farmers little incentive to raise meatier animals. Yet, judged on carcass value, a meat-type hog is sometimes worth $2 to $3 more per hundred pounds live weight than other hogs in the same weight group.

That's why merit-selling of hogs should be the rule rather than the exception. First moves in this direction have been made. Hog grades developed by USDA's Production and Marketing Administration are in use by some packers on a limited scale. Farm Credit Administration researchers have tested hog grading under commercial conditions in Michigan and Virginia. They find that quality buying is practical and can be profitable.

Consumer demand for leaner pork should bring the meat-type hog into his own. In fact, some hog men are already wondering if he's lean enough. Eyeing the 1½-inch backfat of a 225-pound hog, they point out that a 900-pound steer of equal fatness would find few buyers. No wonder—he'd have backfat 6 inches thick!

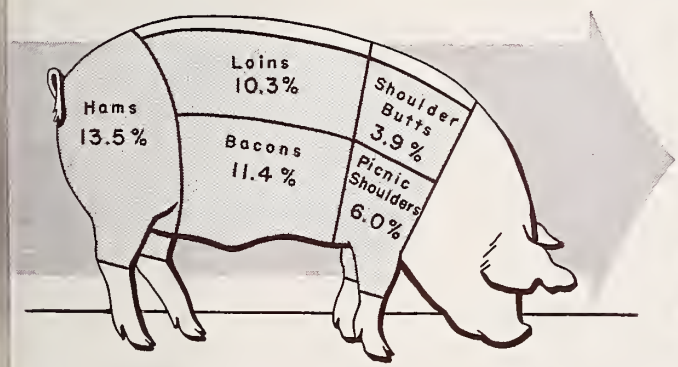
Maybe the meat-type of hog of today is only a first step toward the really meaty hog of the future.

. puts more weight . . . . . into better pork



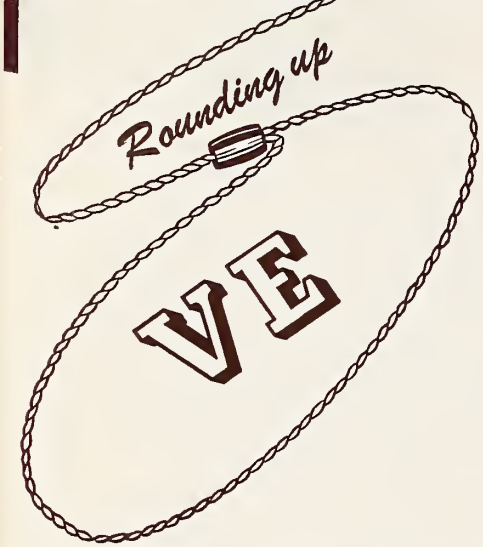
LIVE WEIGHT	205 pounds
DRESSED YIELD	81.5%
PREFERRED CUTS	52.4%

SAMPLE CUTS from meat-type hog have lots of lean in proportion to fat. Meat is top quality and shows that hog received the minimum finish needed to assure high-grade pork without wasting feed.



LIVE WEIGHT	217 pounds
DRESSED YIELD	81.6%
PREFERRED CUTS	45.1%

MORE FAT is evident in cuts from a fat-type or over-finished hog. It's easy to see, by contrast, what the meatier hog offers: Less wasteful trimming and more appealing pork. *(USDA photos by Stenhouse.)*



The big hog run this fall will show what progress we're making toward eradication of vesicular exanthema.

Along with the time-tested defenses of slaughter, quarantine, and sanitation, a new control measure is now widely in effect against VE—the cooking of garbage fed to hogs.

Veterinarians believe that without this requirement, the disease may never be wiped out, because the virus causing VE is spread chiefly through raw garbage.

Of the 745 outbreaks of vesicular exanthema reported since June 1952, when this swine disease began spreading across the country, 485 have been among garbage-fed herds, while only 39 were among grain-fed swine. The remaining 221 outbreaks occurred at hog-cholera serum plants, stockyards, and packing plants, and all that could be traced were found to originate among garbage-fed hogs.

New regulations help. Probably not more than 5 percent of U. S. swine are fed garbage. The high rate of vesicular exanthema among them indicates how important uncooked garbage is in spreading the disease.

As of mid-August, 40 States have enacted legislation or put regulations into effect requiring that garbage be cooked before being fed to swine. Federal regulations governing interstate movement of garbage-fed swine and their products became effective July 1. They specify cooking of garbage and also require disinfection of trucks and facilities used in handling swine moved interstate.

Farmers feeding farmhouse garbage to hogs on their own farms are not required to cook garbage, but they are urged to do so for their own protection and to help the program.

The new regulations have the support—and, in fact, were worked out with the help—of representative hog feeders, stockyard operators, meatpackers, veterinarians, railroad officials, and others dealing with swine. A special industry advisory committee has met with USDA officials and offered many helpful suggestions.

Much of the swine industry has adopted its own sanitary recommendations to help stop VE.

Most States affected. How difficult it is to set up a foolproof defense is shown by the record. For years. vesicular exanthema was confined to California. After is appeared suddenly in Nebraska, about 14 months ago, its spread was rapid. Within a month it had been found in 14 States. Sixty days later, VE had penetrated 12 more States.

In all, 42 States and the District of Columbia have been invaded by the disease. Infection was limited to fairly small areas in some cases, but in others it has been widespread. As of August 17, VE quarantines were in effect in 10 States.

In every case, it was necessary to start eradication and sanitation measures at once, with proper quarantines until the infection could be entirely cleaned out. More than 165,000 infected swine have been slaughtered. This represents a considerable loss, but it's only a fraction of what the cost might have been if prompt and thorough control action had not been taken on each outbreak.

Since the VE emergency was declared more than a year ago, the eradication campaign has been conducted jointly by industry, the States, and the Federal Government. ARA's Bureau of Animal Industry is cooperating with the States in slaughter of infected animals. In most cases, owners are eligible for indemnities, paid half from Federal and half from State funds. Under the new regulations, however, no indemnities will be paid for hogs fed uncooked garbage.

VE costs money. It's important to get rid of VE, not because mortality of hogs is high, but because of other losses resulting from the disease. Infected hogs lose 5 to 10 percent of their weight, and so have less value if slaughtered immediately or take 30 to 60 days to get back in market condition. Also, carcasses of infected hogs must be specially processed. It all adds up to losses for both farmer and meatpacker.

Each infected hog is a reservoir of virus which can infect other swine. There is no known cure for VE and no effective vaccine.

And there's a further serious problem. Although VE affects only hogs, it is similar to foot-and-mouth disease, and it takes specially trained people to tell the two apart. M. R. Clarkson, deputy administrator of ARA, points out the ever-present danger that foot-and-mouth disease might be overlooked as a result of confusing it with vesicular exanthema. Such a mistake could be disastrous for the entire livestock industry.

Critical days ahead. Whether the new defense against VE works or not depends on the observance by all concerned of control regulations now in effect. Cooking garbage—which not only kills the VE virus but also helps control many other swine diseases—plus strict compliance with disinfection and sanitation procedures, from farm to market, can minimize and may eliminate new outbreaks of VE. The big test comes soon, now, as this fall's hog crop moves to market.

Chemicals that can Tailor Plants

Chemical growth regulators may eventually help us tailor crop plants and ornamentals to just the right size to fit everyday needs. This prospect is seen by scientists experimenting with compounds that check growth without causing freak effects.

None of these chemicals is ready now, but tests at the Plant Industry Station suggest many possibilities:

Truck farmers make several plantings of beans to have a crop coming on throughout the season. It might be more economical to plant them all at once, using a growth regulator to hold back parts of the crop.

Shrubs might serve a homestead many years longer if they were treated to keep them from growing so tall that they have to be replaced.

Some plants, such as snapbeans, often produce a mass of stems and leaves but little fruit. A chemical might control this top growth, let more soil nutrients go into beans.

Or suppose we find a growth regulator to dwarf alfalfa. It might be used in hillside pastures to furnish nitrogen, yet not compete with the soil-holding grasses. Such alfalfa could also serve as a growing mulch to keep down weeds in corn.

These are still only possibilities, of course. So far, J. W. Mitchell, P. C. Marth, and W. H. Preston have tested three groups of chemicals: 6 ammonium compounds, 6 nicotiniums, and 13 sulfonates. None of these has been produced in quantity.

The ammoniums are best known. One of the most active is Amo-1618, short for (4-hydroxy-5-isopropyl-2-methylphenyl) trimethyl ammonium chloride, I-piperidine-carboxylate.

On snapbeans, as little as a pound of Amo-1618 to the acre checked growth drastically. Although the stems and leaves of treated plants were thicker as well as deeper green than ordinary beans, there was none of the distortion that chemical growth regulators often produce. Blooming was delayed 3 to 10 days, and maturity lagged a month or more.

Scientists have tested Amo-1618 on 50 other vegetables, field crops, fruits, flowers, and shrubs. Treatments were made in a variety of ways—spraying, dipping, soaking, mixing in the soil. The chemical had a stem-shortening effect on chrysanthemum, sunflower, sesame, and calliopsis. A moderate response was noted on lespedeza, peas, lettuce, tobacco, blue bell, Chinese elm, maple, and pin oak. Alfalfa was slightly affected.

Other tests showed that Amo-1618 helps root chrysanthemum cuttings. At 1 month, the treated chrystanthemums were deep green and only half as tall as untreated plants.

The nicotinium compounds produced much the same effect as the ammoniums—shorter plants, thicker stems and leaves, deeper green color. An effective one was 2,4-DNCl (2,4-dichlorobenzylnicotinium chloride). It worked well on beans and peas.

Of the sulfonate compounds, two were active: benzyldodecyldimethylammonium benzenesulfonate and benzyldimethyl(3,5,5-trimethylhexyl) ammonium benzenesulfonate. Both shortened bean, cucumber, and sunflower; the latter also affected poinsettia and Creole Easter lily.

There's a lot still to be learned about all three groups of compounds before they'll be ready for farm use. Scientists have discovered, for example, that Amo-1618 is unusual in its persistence in soil and seed. Low dosages of this chemical have stayed active in both clay and sandy soils for 2 years. Amo-1618 is carried over in bean seeds and shortens plants for 2 and 3 generations after a treatment. Even after 18 months storage, seeds from treated plants produce beans with short stems.

All this suggests the possibility of undesirable contamination of soils and foods. Obviously, great care will have to be taken in using these chemicals. The question of toxicity has not been answered for any of the compounds tested so far.

Experiments now underway may tell part of the story. In the meantime, scientists are continuing their search for other effective chemicals.

STEM-SHORTENING chemical Amo-1618 was effective on beans and chrysanthemums. Three groups of growth regulators have been tested.

New angle on control of fruit moth

Before DDT, the peach grower's best means for controlling oriental fruit moths was by release of the parasite *Macrocentrus ancylivorus*, a tiny wasp that feeds on the moth larvae. It helped cut average moth damage in half—from about a quarter to an eighth of the total peach crop.

When DDT—and, later, EPN and parathion—became available, research showed that spray applications of these insecticides could reduce peach losses considerably more.

Now ARA entomologists find that using the parasitic wasps early in the season, followed by one insecticidal-spray treatment a few weeks before harvest, may save as many peaches as the insecticide-spray program now recommended.

These results do not warrant a recommendation that growers replace present spraying methods with the wasp-insecticide combination. But they do suggest that using beneficial insects along with insecticides for pest control is worth further study.

Such practices have not been considered feasible, in general, because many insecticides kill beneficial insects as well as pests. But the oriental-fruit-moth parasites can do their work before insecticides are applied, and similar successful results might be obtained in other cases.

The right combination of beneficial insects and insecticides, used against some insects, may offer possibilities for (1) more effective control, (2) more economical control, or (3) less hazard from residues.

Protons aid faster check of moisture

Finding out exactly how much water there is in fruits, vegetables, and other foods is essential in most research aimed at improving food products. To get this information, scientists usually have to weigh food samples before and after drying them in a laboratory oven. The process is slow and costly. Also, it may cause various unwanted changes in the test sample besides loss of moisture.

But now T. M. Shaw and R. H. Elsken of the Western Regional Research Laboratory are perfecting a new way to do the job faster and better. Their method—based on knowledge of how atomic particles behave—gives a quick check of moisture content without altering the material under test. It promises to speed up progress and cut operating costs in hundreds of research projects.

The measuring instrument they use consists of a permanent magnet coupled with an electronic device called a radio-frequency spectrometer. A strong magnetic field is set up around the food by the permanent magnet. The food sample is then subjected to an oscillating electro-magnetic field generated by the spectrometer.

Energy absorbed from the oscillating field by the nuclei (protons) of hydrogen atoms in the sample can be detected by the spectrometer. Since protons absorb more electro-magnetic energy when they occur in a liquid than they do in a solid, spectrometer readings reveal the amount of moisture in the test sample.

Shaw and Elsken have used this method successfully on potatoes, apples, proteins, starch, pectin, and other typical food materials. So far, it gives accurate results only with small samples (0.5 cc.) and does not distinguish adequately between oil and water when both are present. But it is valuable for much research in its present form, and work to improve it for wider use is continuing.

Careful handling and good merchandising step up apple sales

The 1953 apple crop is moving. How fast it moves will probably depend to a great extent on the way the fruit is handled and displayed.

Experiments by Cornell University in 11 upstate New York cities show that wise merchandising can make a big difference. About twice as many pounds of apples per 100 customers were sold when the apples were displayed two ways at once—in 6-pound bags and in bulk—as when either method was used alone. Six-pound packages moved better than other sizes tried in bag-and-bulk displays.

Quality made an impression too. Customers bought 28 percent more of carefully handled apples than of apples that were badly bruised. The few bruises on carefully handled fruit didn't hurt their sales value much.

Cooperative research by the Michigan Experiment Station and ARA gave similar results. Bad bruising slowed sales on more than a third of the apples offered in Michigan's retail stores. Study of handling operations, from tree to retailer, showed that bruising can be greatly reduced at little or no extra cost.

What about refrigerating apples—is it necessary in retail stores? At ARA's Plant Industry Station, W. E. Lewis tried displaying apples both ways—on ordinary racks and in mechanically refrigerated cases—in six shelf-life tests over two seasons.

After 4 days, refrigerated apples had a slight edge in quality and condition. The 45° temperature kept them bright, and they made a desirable ringing sound when rubbed.

Nonrefrigerated apples, at an average of 72°, looked dull and felt oily. A taste panel found no significant difference in ripeness and flavor.

No decay developed in refrigerated apples and an average of less than 1 percent in nonrefrigerated lots. There was one exception: fully ripe, badly bruised apples deteriorated much quicker without refrigeration.

Sprinkling didn't make much difference under either condition.

Apples in good condition probably can be held safely for several days in room-temperature racks. Retailers may find it worthwhile, however, to use their refrigerated cases for apples if the space isn't needed for more perishable produce. And refrigeration is a necessity for ripe fruit that can't be sold at once.

More new varieties

Two new lettuces and two early peaches are among new varieties announced recently by ARA's Bureau of Plant Industry, Soils, and Agricultural Engineering.

ALASKA—a large, dark green lettuce, is late maturing, late bolting, and resistant to tipburn. It is especially suited to Alaska, where it has given high yields and shown resistance to anthracnose.

JADE—a mid-season lettuce, offers special promise as a fall crop in the irrigated valleys of the Southwest. It is large, very dark green, and has leaves heavily savoyed (wrinkled and curled). Jade's most valuable characteristic is its cold resistance in late stages of growth.

CORONET—an early yellow peach, is recommended for trial planting in southern States to replace the commercial variety Dixigem.

MAYGOLD—a new yellow clingstone peach, is recommended for the Deep South. It requires only 650 hours chilling time (below 45° F.) to break the rest period of its buds.

POULTRY

Eggs and COTTONSEED

New feeding experiments tell us more about substances in cottonseed that hold poultrymen to limited use of cottonseed meal, an economical source of high-quality protein.

One of these substances is already well known. It's a compound called gossypol, found in the pigment glands of the seed. Research over the last 20 years shows that gossypol slows chick growth, cuts egg production, reduces hatchability, and causes egg-yolk discolorations that range from olive-green or light chocolate brown to nearly black.

The other substance, however, has never been pinned down. This is the one that causes stored eggs to develop pink albumen and reddish-brown, enlarged yolks.

It's this unidentified substance in which B. H. Heywang was mainly interested during recent studies at the Bureau of Animal Industry's Southwest Poultry Experiment Station, Glendale, Ariz. He wanted to know in what part of the seed this material is found, and whether or not it's removed by certain solvents used in extracting the oil.

Using 100 groups of laying White Leghorn pullets, Heywang included a different cottonseed supplement in the diet of each group. These materials were made in a variety of ways under supervision of the Southern Regional Research Laboratory at New Orleans. The eggs were held in commercial storage at 36° for 1 to 6 months.

A diet containing cottonseed hulls, Heywang found, caused neither yolk enlargement nor discoloration of any kind in stored eggs.

But pink egg whites and oversize yolks did show up in eggs from pullets whose diet included raw cottonseed or cottonseed pigment glands.

Crude cottonseed oil caused similar effects. This doesn't necessarily mean that the oil part of raw cottonseed contains the unidentified substance—it might have been released when the pigment glands were ruptured during the extraction process.

The pullets found no fault with cottonseed meals extracted by two experimental solvents, methyl-ethyl-ketone and iso-butane. But solvent extraction with hexane, used commercially to some extent, failed to remove the color-producing material.

Pink albumen was found in stored eggs that had been laid as early as 3 days after the pullets began to eat the offending cottonseed supplements. More and more eggs showed discoloration as storage time increased.

Heywang noticed that gossypol discoloration also appeared at the 3-day mark. He discovered, however, that practically no trouble developed when he fed a gossypol-glycine compound. Apparently glycine, an amino acid, bound the gossypol so that little was released in the digestive tract.

Most of our cottonseed meals result from pressing the valuable oil out of the seed with hydraulic or screw presses. The process involves cooking, which tends to inactivate gossypol by combining it with certain amino acids. The trouble is that heat also seems to damage the protein.

A great deal of research is being done on making and feeding cottonseed meal. The combined efforts of nutritionists, chemists, equipment manufacturers, and processors should increase the usefulness of this protein source to the poultry industry.

Marks of a Good Milker

Can a cow's body form tell us about her producing ability? Or can we predict, from a calf's conformation, the sort of cow she will be?

There's more and more evidence that the answer to both questions may be yes. A recent discovery, reflecting 30 years of research, is that good milk makers are usually cows with long, deep bodies and long heads.

What scientists are looking for, of course, is a sounder way to select individual animals—young and old. Knowing how to spot producing ability would be helpful not only to classroom teacher and show-ring judge but also to the dairyman who buys, sells, and chooses cattle for his own herd. This could mean millions of dollars a year to the dairy industry.

The idea is at least as old as the show rings of a century and a half ago. According to long-popular theories, a cow's outside form is related to the size of her body cavities, chest, and internal organs. Large cavities and organs are supposed to mean strong constitution and good feeding capacity. And these, so the teaching goes, are essential for high, efficient production.

The truth is that such theories were never backed by much in the way of research. Beauty of form was too often given undue importance.

W. W. Swett of the Bureau of Dairy Industry wasn't satisfied with these theories, and he set to work in 1923 to find the facts. The first thing he did was to study nearly 400 cows at a Chicago packing plant to see if he could discover a relation between external form and internal anatomy. After several measurements were taken on each cow, she was slaughtered and the carcass and internal organs were weighed and measured.

Swett found that internal anatomy may vary a great deal, even with animals of the same body size and shape. It seemed doubtful that the feeding capacity of a cow could be judged on the basis of outside form. On the other hand, body depth seemed to be a reliable indicator of the size of internal organs.

The results led to a project that has been carried on for 30 years.

Using cows that had served in the experimental herd at Beltsville, Swett began to collect the data he needed to find relationships among (1) external form, (2) size of organs and body cavities, and (3) production.

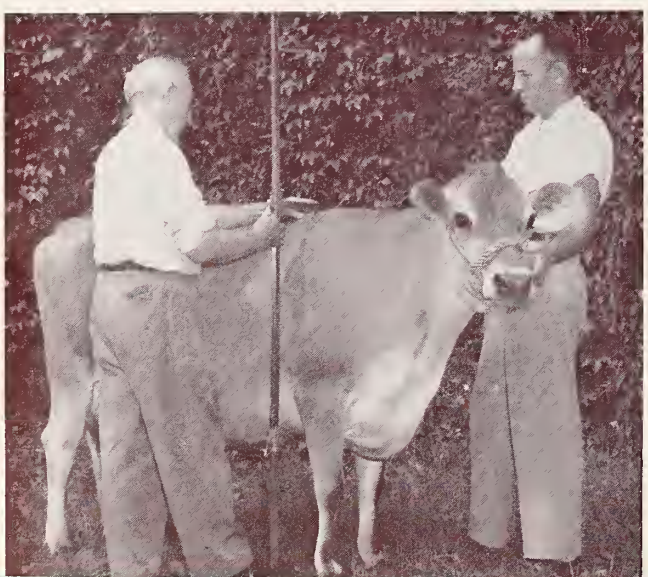
Each cow had shown her milking ability. Before slaughter, she was photographed and 37 body measurements were taken. Then 82 post-mortem weights and measurements were recorded.

Some 20 State experiment stations joined in a cooperative arrangement to handle their discarded cows in the same way. The information was assembled at Beltsville.

Swett's goal of 1,000 cows has now been reached, and the job of analyzing the data is underway. One part already finished deals with the relationship between body measurements of 350 Holstein and 346 Jersey cows and their records of milk production.

Results seem to indicate that neither live weight nor body width has much correlation with production. Body circumferences were significant in Holsteins but not in Jerseys. Body

DEEP BODY at forechest is closely related to a cow's milk record.



LONG HEAD seems to be consistent mark of a good producer.

heights and lengths were definitely correlated with production in Jerseys, less so in Holsteins. Head widths seemed to be important. But length of head was the body measurement most consistently correlated with milk production in both breeds.

Results of other phases will be published as analysis is completed.

Naturally, the earlier that good selections can be made, the better it will be for the dairyman. He loses money when he spends 3 years of labor, feed, barn space. and worry raising a calf that turns out to be a poor milker. Furthermore, a method of calf selection would enable breeders to evaluate transmitting ability of herd sires 2 years earlier than is now possible.

That's why dairymen and scientists the world over have shown so much interest in the Beltsville system of examining calves' mammary glands. Rudiments of these glands can be felt with the thumb and fingers as early as 1 month. Preliminary study indicated that glandular development at 3 to 5 months is a good indicator of future producing ability.

More than 5,000 calves have now been checked in this way at Beltsville and nearly 40 State experiment stations and other cooperating agencies. Milk records these animals make will tell us a great deal about the reliability of the gland test.

Scientists are now finding evidence that the body dimensions of a heifer calf can give us a good preview of her form as a cow. The development of some 400 animals at Beltsville has been carefully followed from birth through the first lactation, and in some cases as long as 6 years. Many of the measurements at 3 months are closely correlated with the same dimensions in the cow. Perhaps it will be possible to connect this relationship with milk production.

As advances continue on several fronts, prospects for better selection methods seem good.

FOOD and HOME

Bread with SOY PRODUCTS

Enriching bakery bread with high-protein soy flour is a good way to improve our diets and also to extend the market for soybeans, say scientists of the Northern Regional Research Laboratory, Peoria, Ill.

They also report that two soybean ingredients may help the baking industry meet consumer demand for soft bread. These fractions, called "Gelsoy" and "soybean whey solids," increase bread-crumb softness when added to flour on the basis of 1 percent of flour weight.

Soy Flour—Excellent bread can be made. according to C. W. Ofelt and his Northern Laboratory associates, by blending 1 part soy flour with 20 parts wheat flour—provided that a proper amount of potassium bromate (an oxidizing agent that helps produce lighter, larger loaves) is used in the baking formula.

Protein makes up 50 percent of soy flour, compared to 16 percent in high-protein wheat flour. Since many families use 1½ to 3 pounds of bread a week per person, added protein in bread could help considerably in maintaining good diets.

Extensive taste tests have revealed little or no difference in flavor between 5-percent soy-flour bread and similar loaves made with all-wheat flour. Also, the soy flour doesn't impair the bread's physical characteristics—loaf volume, crumb grain, color, and texture.

Improvements in processing have made high-quality soy flour available to bakers. Ofelt points out, however, that they should be careful to use higher than normal amounts of the oxidizing agent with soy flour. The right amount may vary with different lots of flour.

Soy Softeners—The bread-softening ability of Gelsoy provides a new use for this product, which was developed at the Laboratory a few years ago as a vegetable gel for meringues, ice creams, and other foods, and as a binding or foaming agent for non-food products.

Soybean whey solids, also useful as a bread softener. are the portion of soybean meal left after most of the protein is extracted. They now constitute a serious waste disposal problem, and their low-cost recovery would be beneficial to both soybean processors and the public.

Both Gelsoy and soybean whey solids are now undergoing pilot-plant tests to determine their suitability for commercial production.

In-package desiccants aid dried-food quality

Food manufacturers are showing much interest in the process of in-package desiccation, which helps insure good quality of dehydrated and certain other foods in storage. It involves packing a chemical drying agent, such as calcium oxide or silica gel, kept separate in a moisture-permeable container, with food to reduce its moisture content. ARA's Western Regional Research Laboratory has shown that this method can minimize or eliminate flavor changes and loss of nutritive value in many foods during storage at high temperatures. One use of desiccants is with the new puff-dried orange-juice powder (AGR. RES., Mar.–Apr. 1953).

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AGRISEARCH Notes

Helping the cotton picker

To get the highest yields of mechanically harvested cotton and make best use of cotton-picking machinery, the number of plants grown per acre should be at least 20,000 and not more than 60,000. This was demonstrated in tests at the U. S. Cotton Field Station at Shafter, Calif., in cooperation with the agricultural experiment station of the University of California.

A relatively large number of cotton plants per acre helps overcome the tendency of machine pickers to miss bolls that are near the ground. In fields with heavier plant populations, cotton grows taller, and the lowest bolls develop higher above ground than usual, which makes them easier for picking machines to reach. Also, the taller plants have fewer and smaller lateral branches, and this contributes to greater efficiency of the machines and reduces the quantity of litter picked up.

With specially designed equipment used at Shafter, it was found that cultivation after normal lay-by time could be done without damage to the crop. This proved a further advantage to mechanical harvesting.

Detecting the pink bollworm

Electric light traps can aid in detecting new infestations of the pink bollworm. They are not, however, recommended to farmers for pink-bollworm control.

ARA engineers and entomologists are cooperating with the Texas agricultural experiment station in light-trap experiments. Their tests so far show that so-called "black-light" traps, providing near ultra-violet radiation, are the most successful.

Besides their use in detecting the pink bollworm in areas not previously known to be infested, the traps may also prove practical for migration studies, timing of insecticide applications, and determining the intensity of pink-bollworm infestations.

New Bermuda-grass hybrids

Two new hybrid Bermuda grasses—Suwanee for pastures and Tiffine for turf—have been announced by USDA and the Georgia Coastal Plain Experiment Station. They were developed in State-Federal research by G. W. Burton and coworkers at Tifton, Ga.

SUWANEE, which does well on deep sand, has outstanding ability to make use of nitrogen applied as fertilizer. Tests show that it can recover an average of 76 percent of the nitrogen when grown on soils treated with 50 pounds of nitrogen fertilizer per acre. In comparison, Coastal Bermuda and Pensacola Bahia recovered 67 percent and common Bermuda grass 25 percent. Suwanee Bermuda produced 13 percent more beef per acre than Coastal Bermuda or Pensacola Bahia in a 4-year grazing test on highly sandy soil at the Range Cattle Station, Ona, Fla.

TIFFINE, a new turf grass for putting greens, is unusually fine in texture. It has a distinctive medium-green color and is disease resistant, aggressive, and not injured by overseeding with ryegrass. Indications are that Tiffine is well adapted throughout the Southeast.

New wilt-resistant tobacco

DIXIE BRIGHT 28 is the latest in a series of flue-cured tobaccos with high resistance to bacterial (Granville) wilt, developed by USDA and the North Carolina Agricultural Experiment Station. Its yields in 3-year tests averaged 1938 pounds of tobacco per acre. In both yield and value of tobacco, it excelled Dixie Bright 27 and Oxford 26, the wilt-resistant varieties previously developed, which are now widely grown commercially. Since Dixie Bright 28 is not resistant to black shank, it is expected to prove most useful in the upper Middle Belt of North Carolina and in the Border Belt counties, where this disease has not become a problem.

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